

Hurricane Katrina: Social-Demographic Characteristics of Impacted Areas

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Summary

On the morning of August 29, 2005, Hurricane Katrina made landfall on the Gulf Coast between the major cities of New Orleans, Louisiana, to the west, and Mobile, Alabama, to the east. Along the Gulf Coast and inland in the swath of the storm, Hurricane Katrina impacted hundreds of thousands of families in three states (Louisiana, Mississippi, and Alabama) and contributed to the deaths of more than 1,000 people. While CRS estimates that 5.8 million people in three states may have experienced hurricane-force winds, the majority rode out the storm safely. Property damage, loss of life, and sizeable displacement of the population appear to have been largely concentrated along the Gulf Coast within a 100-mile radius of where the storm made landfall. Within this area, damage due to high winds and storm surge resulted in significant devastation, but flooding, largely resulting from breached levees and flood walls, affected the greatest number of people, with much of New Orleans flooded.

CRS estimates that 700,000 or more people may have been acutely impacted by Hurricane Katrina, as a result of residing in areas that flooded or sustained significant structural damage. This estimate is based on geographical analysis of Federal Emergency Management Agency (FEMA) flood and damage assessments and year 2000 Census data. The estimates in this report are subject to the methods and assumptions used. Other agencies and organizations are conducting assessments using alternative and complementary methodologies; estimates may differ depending upon the specific methodologies used. In the case of this analysis, the estimates reflect the numbers and characteristics of people, families, and households in 2000, who lived in areas that suffered damage or flooding from the hurricane in 2005.

The analysis shows that the Louisiana parishes of Orleans and St. Bernard were especially hard hit by flooding, with an estimated 77% of Orleans's population affected, and nearly all residents of St. Bernard. In Mississippi, 55% of Hancock County's population is estimated to have been affected by flooding and/or structural damage, and in the more populous Harrison County, about 19% of its population. In Louisiana, an estimated 645,000 people may have been displaced by the hurricane (based on 2000 Census data), and in Mississippi, 66,000.

Hurricane Katrina had varying impacts on the population. CRS estimates that of the people most likely to have been displaced by the hurricane, about half lived in New Orleans. Due to the city's social and economic composition, the storm impacted heavily on the poor and African Americans. CRS estimates that one-fifth of those displaced by the storm were likely to have been poor, and 30% had incomes that were below 1½ times the poverty line. African Americans are estimated to have accounted for approximately 44% of the storm victims. An estimated 88,000 elderly persons (age 65 and older), many with strong community ties, may have been displaced, along with 183,000 children, many of whom were just starting the school year when the storm struck. Katrina's impact on individuals, families, and communities will be felt for years to come, and will take time to fully comprehend.

This report will not be updated.

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Introduction

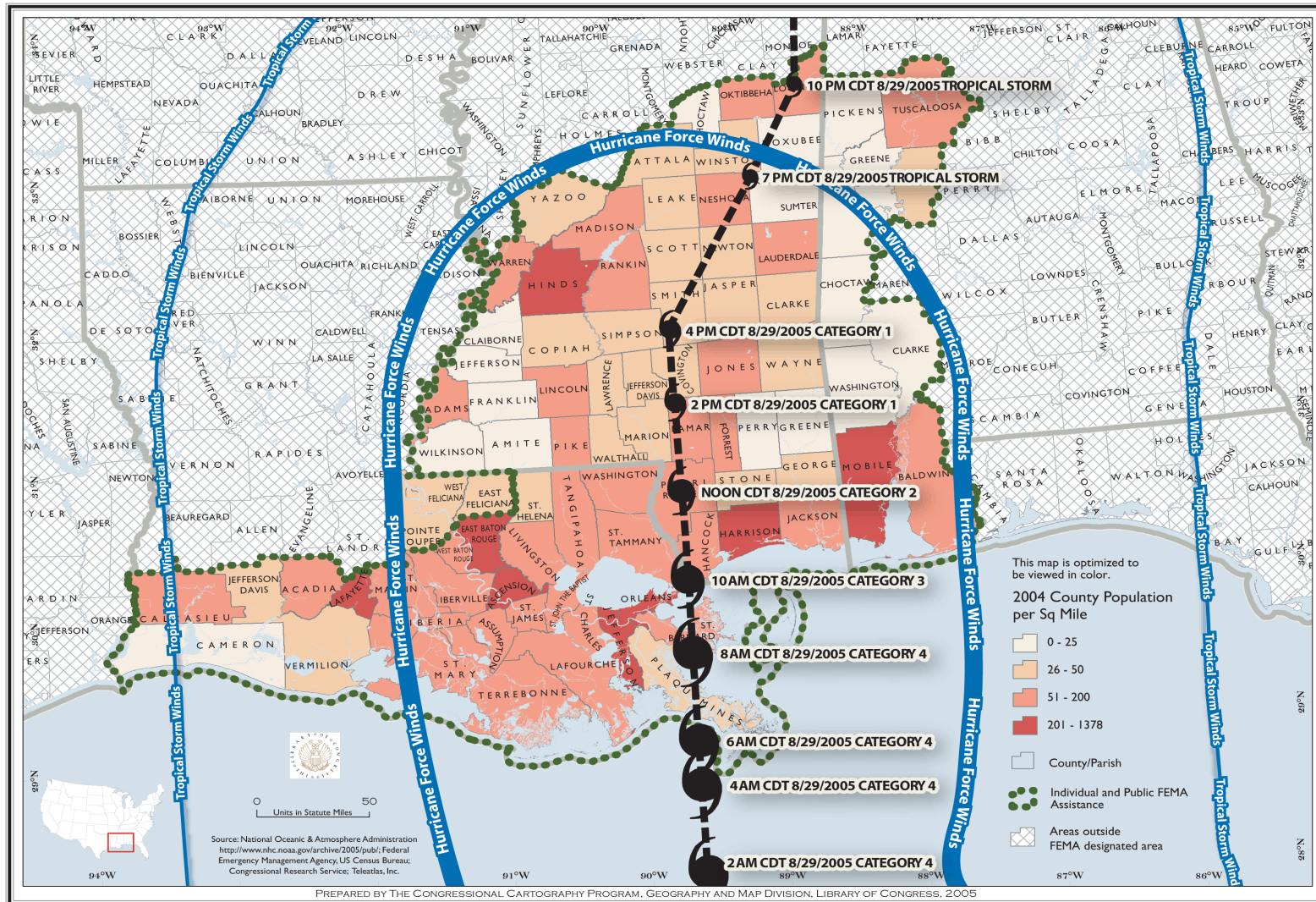
On the morning of August 29, 2005, Hurricane Katrina made landfall on the Gulf Coast between the major cities of New Orleans, Louisiana, to the west, and Mobile, Alabama, to the east. Along the Gulf Coast and inland in the swath of the storm, Hurricane Katrina impacted hundreds of thousands of families in three states (Louisiana, Mississippi, and Alabama) and contributed to the deaths of more than 1,000 people.¹ While CRS estimates that 5.8 million people in three states may have experienced hurricane-force winds, the majority rode out the storm safely. The geographic range of Katrina's hurricane-force winds corresponds quite closely with the 88 counties declared as disaster areas by the Federal Emergency Management Agency (FEMA).² (See **Figure 1**, depicting Hurricane Katrina's storm track, estimated extent of hurricane and tropical force winds, counties designated FEMA disaster areas, and county population density.³) Property damage, loss of life, and sizeable displacement of population appear to have been largely concentrated within a 100-mile radius of where the storm made landfall. Within this area, damage due to high winds and storm surge resulted in significant devastation, but flooding, largely resulting from breached levees and flood walls, affected the greatest number of people, with much of New Orleans flooded.

¹ "Katrina's official death toll tops 1,000." CNN. September 21, 2005. <http://www.cnn.com/2005/US/09/21/katrina.impact/>.

² These counties were declared eligible for individual and household assistance. Government entities in wider areas of the states were declared eligible for other forms of disaster aid but are not included in this count. See the section, *Hurricane Katrina FEMA Declared Disaster Areas*, later in this report.

³ The hurricane's storm track is based on National Weather Service/National Hurricane Center advisories. See <http://www.nhc.noaa.gov/archive/2005/KATRINA.shtml?>. The strength of the hurricane is shown according to the Saffir-Simpson scale. A Category 4 hurricane has maximum sustained winds between 131-155 miles per hour, a Category 3 hurricane, between 111-130 mph; a Category 2 hurricane, between 96-110 mph, and a Category 1 hurricane, between 74-95 mph. See <http://www.nhc.noaa.gov/aboutsshs.shtml>. Tropical storm force winds are defined as sustained winds between 39 and 73 mph.

Figure 1. Hurricane Katrina: Storm Track and Counties Designated Eligible for Disaster Assistance (FEMA Individual Assistance), with 2004 County Population Density



Fourteen counties with a combined population of 2.5 million people experienced some flooding and/or structural damage based on FEMA flood and damage assessments. All of these counties are within the 100-mile radius of the storm's landfall. Included in this region are the cities of New Orleans (estimated to have 445,000 people), the Biloxi-Gulfport-Pascagoula Mississippi metropolitan area (estimated at 364,000 people), and Mobile (County) Alabama (estimated at 393,000 persons).⁴

The populations of these 14 counties bore the brunt of the storm; however, the impact was not uniform across the counties. Using a combination of FEMA damage assessment and Census data, CRS estimates that within these 14 counties, about 700,000 people may have been the most acutely impacted by Hurricane Katrina, experiencing flooding and/or significant structural damage. (See **Figure 2**, which provides an overview of the areas most directly impacted by the storm.) It is this population—those most severely impacted—that is the report's primary focus.

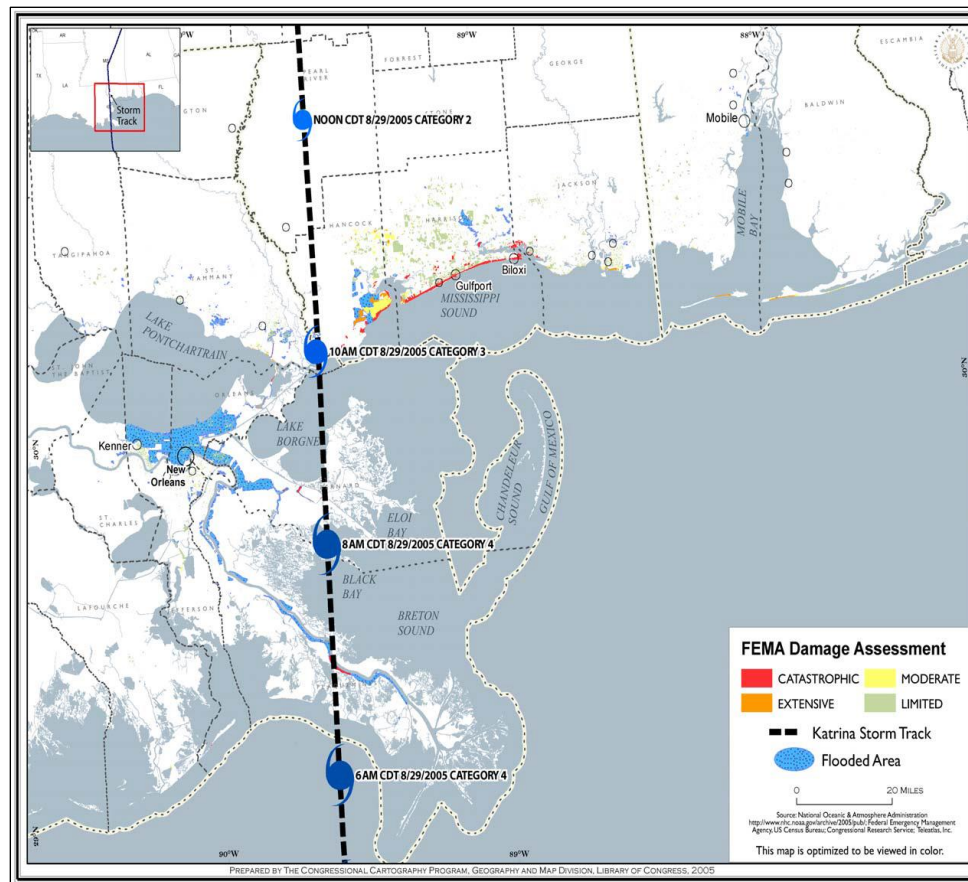
Structure of the Report

This report begins with a discussion of FEMA's disaster declaration process and its application to Hurricane Katrina. It then presents CRS estimates of the population, living within 14 of the 88 counties designated as eligible for disaster assistance, who were most affected and most likely displaced by the storm, in total and in each of the three affected states: Louisiana, Mississippi, and Alabama. These estimates are broken down by whether people were living in areas that experienced flooding and/or structural damage (and further, by the level of structural damage). The balance of the report presents a social-demographic profile of this acutely affected population, looking at such characteristics as poverty and race/ethnicity status, homeownership and housing status. Separate discussions are also provided of the aged, children, and working-age adults. Although this report does not explicitly discuss policy implications, its findings are relevant to numerous aspects of the post-Katrina debate on how to address the immediate and ongoing needs of the affected populations, both in their home counties as well as the many other parts of the country to which some have relocated.

CRS estimates in this report are based on the mapping of FEMA flood and damage assessments (September 21, 2005 data) applied to Census 2000 data. The estimates provide a rough approximation of the numbers and characteristics of persons, families, and households that are most likely to have been impacted by the hurricane. Other agencies and organizations are conducting assessments using alternate and complementary methodologies. Estimates may differ, depending upon the specific methodologies used. The estimates presented in this report rely heavily on the completeness and accuracy of the FEMA flood and damage assessment data. The FEMA data are likely to have captured most, but not all hurricane-related damage, and miss inland damage along the hurricane's storm track through Mississippi (mostly less than catastrophic damage). See the discussion on the Status of Other Assessments and Appendix A (Methodology).

⁴ Based on U.S. Census Bureau 2004 American Community Survey (ACS) data. Estimates are limited to household populations, and exclude persons living in institutions, college dormitories, and other group quarters.

Figure 2. Hurricane Katrina: Overview of Areas Affected by Flooding and/or Structural Damage (Based on FEMA Flood and Damage Assessments)



Hurricane Katrina FEMA Declared Disaster Areas

The Presidential declaration of a major disaster identifies the types of disaster assistance available in affected areas (usually counties, or the state equivalent of counties or independent cities). The Robert T. Stafford Disaster Relief and Emergency Assistance Act authorizes a range of federal aid for states, localities, and households in the event of a Presidentially declared major disaster. The declaration process for “emergencies” is similar to that used for major disasters, but the criteria (based on the definition of “emergency”) are less specific.⁵ The two major categories of assistance are public assistance, which encompasses various forms of aid to state and local governments and some nonprofit organizations, and federal assistance to individuals and households.⁶ Federal assistance is provided to individuals and households who are uninsured or underinsured to pay for necessary expenses as a result of the disaster that cannot be met otherwise, and may include financial help to occupy alternative housing, provision of temporary housing units, home repair, and aid for other expenses.

FEMA has issued regulations that specify the criteria for determining whether individual and household assistance is available in an area. Though the Stafford Act provides for Presidential discretion in designating areas as eligible for disaster aid, the regulations include the following factors for considering whether individual and household assistance should be available in an area: (1) concentration of damage; (2) the degree of trauma to a state and communities, such as large numbers of injuries or deaths, large scale disruptions of normal community functions, and emergency needs such as extended or widespread loss of power; (3) special populations, such as whether the area includes low-income, elderly or unemployed persons; (4) the extent to which state and local or voluntary agencies can meet needs; (5) the amount of insurance coverage in an area; and (6) the amount of individual assistance provided by the state.⁷ In all, a total of 31 parishes in Louisiana, 47 counties in Mississippi, and 10 counties in Alabama were declared eligible for individual and household disaster assistance. Government entities in wider areas of these states were declared eligible for other forms of disaster aid.

Hurricane Katrina—Estimates of Population Affected in Impacted Areas

The analysis that follows focuses on the population in those areas that were hardest hit by the hurricane—those communities that experienced significant damage from flooding (excluding areas with saturated soil) or that had assessed structural damage (excluding limited damage). The estimates are based on an analysis of Census 2000 Census Tract level data and FEMA damage assessment data, mapped into a Geographic Information System (GIS).⁸ It should be emphasized that the estimates are based on 2000 Census data,

⁵ A Stafford Act “emergency” is “any occasion or instance for which, in the determination of the President, federal assistance is needed to supplement state and local efforts and capabilities to save lives and to protect property and public health and safety, or to lessen or avert the threat of a catastrophe in any part of the United States.” 42 U.S.C. 5122(1).

⁶ For a comprehensive list of the types of aid authorized by the Stafford Act, see CRS Report RL33053. *Federal Stafford Act Disaster Assistance: Presidential Declarations, Eligible Activities, and Funding*, by Keith Bea.

⁷ See regulations at 44 CFR 206.48(b).

⁸ Areas of assessed damage and flooding were apportioned by Census Block (the smallest unit of Census geography), based on the population in the Block, and the Block’s overlapping and non-overlapping habitable

reflecting the number and characteristics of the population at that time—as if Hurricane Katrina struck in April 2000, as opposed to August 2005.

FEMA Damage Assessment Criteria

FEMA’s damage assessment is characterized by several damage categories:

- **Structural Damage**
 - **Catastrophic Damage:** Most solid and all light or mobile structures are destroyed;
 - **Extensive Damage:** Some solid structures are destroyed; most sustain exterior and interior damage (e.g., roofs are missing, interior walls exposed), most mobile homes and light structures are destroyed;
 - **Moderate Damage:** Solid structures sustain exterior damage (e.g., missing roofs or roof segments); some mobile homes and light structures are destroyed, many are damaged or displaced;
 - **Limited Damage:** Generally superficial damage to solid structures (e.g., loss of tiles or roof shingles); some mobile homes and light structures are damaged or displaced;
- **Flood/water Damage**
 - **Flood:** Indicates a separate severe damage category related to the specific effects of flooding;
 - **Saturated Area:** Indicates the possibility of water damage due to saturated soil.

It should be noted that flood and water damage are assessed separately from structural damage. Consequently, areas that are designated as flooded may or may not also contain areas of assessed structural damage. Similarly, some areas with structural damage may also be assessed as flooded.

Population Estimates

CRS estimates that more than 700,000 people were most acutely impacted by Hurricane Katrina, having lived in neighborhoods that either experienced flooding or significant structural damage (catastrophic, extensive, or moderate). Persons who lived in areas that experienced only limited damage, unless also flooded, or in non-flooded saturated areas, are excluded from this estimate. Approximately 657,000 people lived in areas that were flooded, accounting for over 90% of those most acutely impacted by the storm. Among the 657,000 people likely impacted by flooding, approximately 25,000 also lived in areas with significant structural damage that was either catastrophic (5,000), extensive (4,200), or moderate (15,400). In non-flooded areas, approximately 54,000 people were impacted by catastrophic (35,000), extensive (5,600), or moderate structural damage (13,700)—likely due to wind and/or surging water.

area (i.e., land, as opposed to water) with the assessed damage areas. Apportioned Census Block populations, by percent in flood areas, and/or areas with assessed structural damage, were then summed up by Census Tract. The apportionment rates were then applied to Census 2000 summary tract level data, which provide information about the social, demographic, income, and housing characteristics of the population, in order to describe populations most severely impacted by the hurricane. For a fuller description of the methodology used, see **Appendix**.

Because areas could be affected by both flooding and structural damage, we have regrouped areas affected into the following, non-overlapping groups, to avoid double counting and to capture the populations most directly impacted by the storm:

- Catastrophic damage, regardless of flood status (40,000);
- Flooded, excluding areas of catastrophic damage (652,000);
- Non-flooded, extensive damage (5,600); and
- Non-flooded, moderate damage (13,700).

People who lived in areas that were affected only with limited damage (144,000), or non-flooded saturated areas (not assessed in this analysis) are grouped with the remainder of the population in the 14 counties/parishes chosen for this analysis, based on the FEMA damage/flood assessment (see **Table 1**).

Flooding

As noted above, flooding is a separate assessment criterion, which may or may not overlap with assessed structural damage. Here, areas that had flooding and structural damage, other than catastrophic damage, are classified as flooded, along with those areas that only had flooding, and no assessed structural damage. The preponderance of the population who lived in flooded areas were concentrated in Louisiana (97% of the total). St. Bernard Parish, to the south-east of New Orleans, was especially hard hit by flooding, with an estimated 65,000 affected—nearly its entire population (97%). Over three-quarters (372,000) of Orleans Parish’s population is estimated to have been affected by flooding, nearly half (13,000) of Plaquemines Parish’s population, also to the south-east of New Orleans, and about two-fifths (181,000) of Jefferson Parish’s population, just to the west and south of New Orleans. (See **Figure 3**.)

In Mississippi, nearly 22,000 people appear to have been affected by flooding, with the majority (20,000) concentrated in Hancock County, the western most county on the Mississippi Gulf Coast, just to the northeast of New Orleans, Louisiana.

Alabama experienced little flooding that directly impacted populated areas.

Table 1. Estimated Number of Persons Living in Counties with Assessed Damage or Flooding From Hurricane Katrina and Number Living in Areas with Significant Flooding or Damage

(Based on FEMA Flood and Damage Assessments and Census 2000 Population)

	Total population in selected counties/ parishes	Population affected by flooding or structural damage (other than limited) ^a					No damage or limited damage only
		Total	Flooding	Assessed Structural Damage			
				Catastrophic	Extensive	Moderate	
Total—Selected Counties/ Parishes	2,458,789	711,698	652,291	40,146	5,570	13,690	1,747,091
Alabama (selected counties)	540,258	970	20	-	296	655	539,288
Baldwin	140,415	304	-	-	79	225	140,111
Mobile	399,843	666	20	-	216	430	399,177

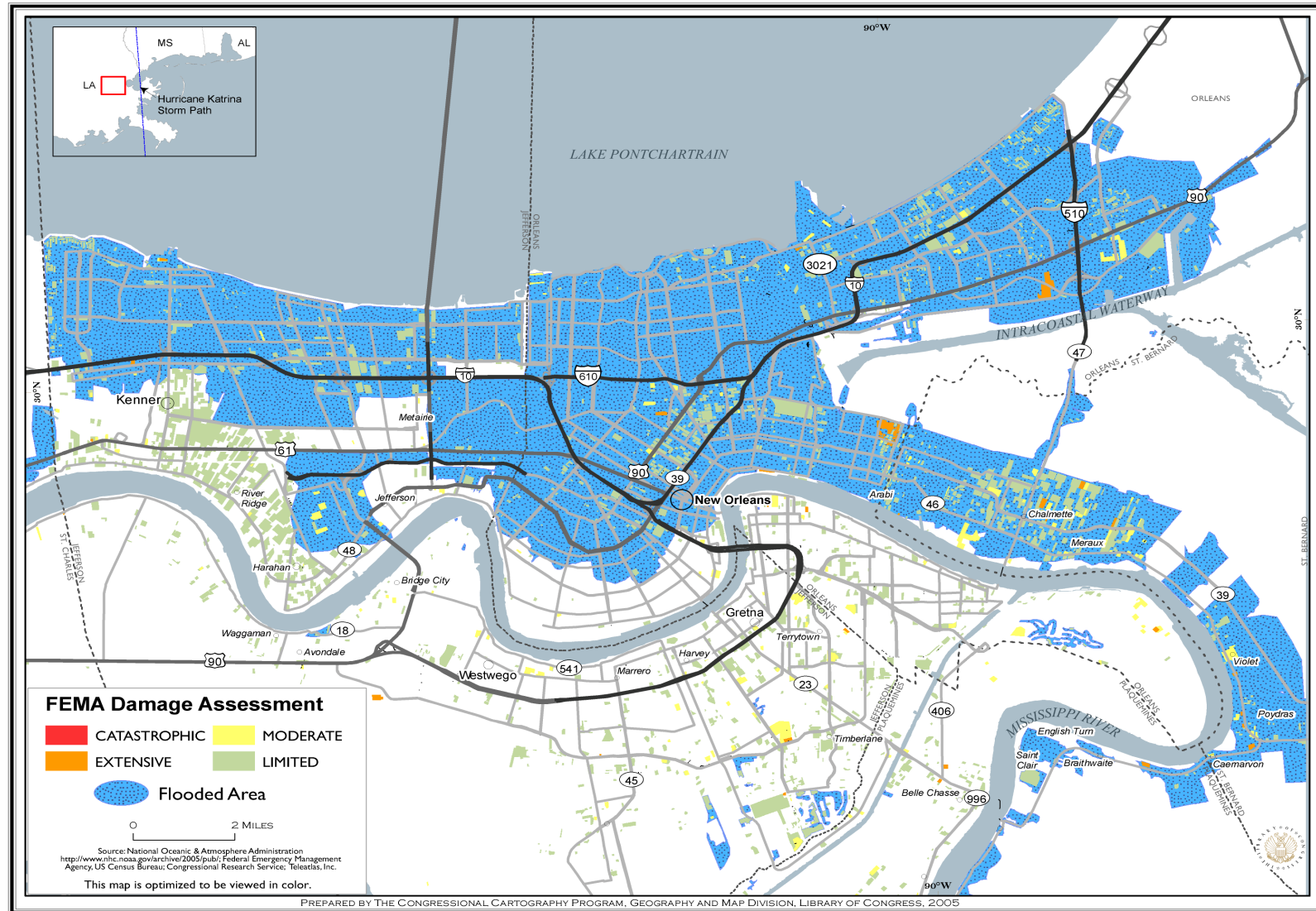
	Total population in selected counties/ parishes	Population affected by flooding or structural damage (other than limited) ^a					No damage or limited damage only
		Total	Flooding	Assessed Structural Damage			
				Catastrophic	Extensive	Moderate	
Louisiana (selected parishes)	1,554,948	644,731	633,950	2,384	604	7,792	910,217
Jefferson	455,466	185,842	180,691	19	75	5,057	269,624
Lafourche	89,974	69	0	-	-	69	89,905
Livingston	91,814	21	21	-	-	-	91,793
Orleans	483,779	373,206	371,697	161	87	1,261	110,574
Plaquemines	26,757	13,048	11,341	1,516	33	157	13,709
St. Bernard	67,229	65,153	64,955	192	-	6	2,076
St. Charles	48,072	672	620	-	1	51	47,400
St. Tammany	191,268	6,706	4,610	496	409	1,191	184,562
Tangipahoa	100,588	15	15	-	-	-	100,573
Mississippi (selected counties)	363,583	65,996	18,321	37,762	4,670	5,243	297,587
Hancock	42,967	23,477	17,624	3,652	837	1,363	19,490
Harrison	189,196	35,169	572	31,405	883	2,310	154,027
Jackson	131,420	7,350	125	2,705	2,951	1,569	124,070
Percentage share of population in selected counties or parishes affected							
Total—Selected Counties/Parishes	100.0%	28.9	26.5	1.6	0.2	0.6	71.1
Alabama (selected counties)	100.0%	0.2	0.0	-	0.1	0.1	99.8
Baldwin	100.0%	0.2	-	-	0.1	0.2	99.8
Mobile	100.0%	0.2	0.0	-	0.1	0.1	99.8
Louisiana (selected parishes)	100.0%	41.5	40.8	0.2	0.0	0.5	58.5
Jefferson	100.0%	40.8	39.7	0.0	0.0	1.1	59.2
Lafourche	100.0%	0.1	0.0	-	-	0.1	99.9
Livingston	100.0%	0.0	0.0	-	-	-	100.0
Orleans	100.0%	77.1	76.8	0.0	0.0	0.3	22.9
Plaquemines	100.0%	48.8	42.4	5.7	0.1	0.6	51.2
St. Bernard	100.0%	96.9	96.6	0.3	-	0.0	3.1
St. Charles	100.0%	1.4	1.3	-	0.0	0.1	98.6
St. Tammany	100.0%	3.5	2.4	0.3	0.2	0.6	96.5
Tangipahoa	100.0%	0.0	0.0	-	-	-	100.0
Mississippi (selected counties)	100.0%	18.2	5.0	10.4	1.3	1.4	81.8

	Total population in selected counties/ parishes	Population affected by flooding or structural damage (other than limited) ^a					No damage or limited damage only
		Total	Flooding	Assessed Structural Damage			
				Catastrophic	Extensive	Moderate	
Hancock	100.0%	54.6	41.0	8.5	1.9	3.2	45.4
Harrison	100.0%	18.6	0.3	16.6	0.5	1.2	81.4
Jackson	100.0%	5.6	0.1	2.1	2.2	1.2	94.4
County/parish share of total population affected by flooding or damage							
Total—Selected Counties/Parishes	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Alabama (selected counties)	22.0	0.1	0.0	-	5.3	4.8	30.9
Baldwin	5.7	0.0	-	-	1.4	1.6	8.0
Mobile	16.3	0.1	0.0	-	3.9	3.1	22.8
Louisiana (selected parishes)	63.2	90.6	97.2	5.9	10.8	56.9	52.1
Jefferson	18.5	26.1	27.7	0.0	1.3	36.9	15.4
Lafourche	3.7	0.0	0.0	-	-	0.5	5.1
Livingston	3.7	0.0	0.0	-	-	-	5.3
Orleans	19.7	52.4	57.0	0.4	1.6	9.2	6.3
Plaquemines	1.1	1.8	1.7	3.8	0.6	1.1	0.8
St. Bernard	2.7	9.2	10.0	0.5	-	0.0	0.1
St. Charles	2.0	0.1	0.1	-	0.0	0.4	2.7
St. Tammany	7.8	0.9	0.7	1.2	7.3	8.7	10.6
Tangipahoa	4.1	0.0	0.0	-	-	-	5.8
Mississippi (selected counties)	14.8	9.3	2.8	94.1	83.8	38.3	17.0
Hancock	1.7	3.3	2.7	9.1	15.0	10.0	1.1
Harrison	7.7	4.9	0.1	78.2	15.8	16.9	8.8
Jackson	5.3	1.0	0.0	6.7	53.0	11.5	7.1

Source: Estimates prepared by the Congressional Research Service (CRS) with assistance from the Library of Congress Congressional Cartography Program, based on analysis of FEMA flood and damage assessments and U.S. Census Bureau 2000 Summary File 4 (SF4) data files.

- a. Flooded and areas of assessed structural damage have been reclassified as follows, to avoid double counting.
Flooded: Any flooded area, excluding areas of catastrophic damage. Includes areas with extensive, moderate, or limited damage where flooding also occurred, and areas where there was only flooding.
Catastrophic damage: Areas of catastrophic damage, regardless of flood status.
Extensive damage: Areas of extensive damage, other than those areas that also experienced flooding.
Moderate damage: Areas of moderate damage, other than those areas that also experienced flooding.

Figure 3. Hurricane Katrina: FEMA Damage Assessment—New Orleans and Vicinity



Catastrophic Structural Damage

As noted above, an estimated 40,000 persons lived in areas that experienced catastrophic damage. In such areas, most structures were destroyed. The majority of the population affected by catastrophic damage lived in Mississippi (94%), and was concentrated predominantly in Harrison County, which includes the cities of Biloxi and Gulfport. In Harrison County, 31,000 people are likely to have been displaced by catastrophic hurricane damage; they account for about four-fifths of the population that experienced catastrophic damage, and about 17% of that county's population. (See **Figure 4.**)

In Louisiana, an estimated 2,400 people are likely to have experienced catastrophic damage. Over 60% of this group (or 1,500 people) lived in Plaquemines Parish, where Katrina first made landfall. These 1,500 people comprise 5% of that parish's population.

In Alabama, no catastrophic damage was assessed, and as noted above, minimal flooding affecting populated areas.

Extensive and Moderate Damage

An estimated 9,700 persons lived in areas that incurred extensive damage and 29,000 persons in areas that incurred moderate damage. Extensive damage means that some structures are destroyed and most have exterior and interior damage; and most mobile homes and light structures are destroyed. In the moderate damage category, solid structures withstood exterior and interior damage, and some mobile homes are destroyed.

Again, as with catastrophic damage, Mississippi accounted for the bulk of the population affected by extensive (66%) and moderate (53%) damage. Hancock County, to the west of Gulfport, had higher concentrations of its population affected by extensive and moderate hurricane damage (33%) than bordering Harrison County (2%), or Jackson County (3%), further to the east, which encompasses Pascagoula.

In Louisiana, Orleans Parish accounted for the majority of the state's population impacted by extensive damage (2,000, or two-thirds of those affected by extensive hurricane damage in Louisiana). Jefferson Parish accounted for over two-fifths (5,300) of Louisiana's population affected by moderate hurricane damage (13,000).

In Alabama, Mobile and Baldwin Counties experienced no catastrophic damage, though some Alabamians are estimated to have lived in areas that experienced extensive damage (300) or moderate damage (660).

Figure 4. Hurricane Katrina: FEMA Damage Assessment—Mississippi Gulf Coast, Bay St. Louis to Biloxi and Vicinity

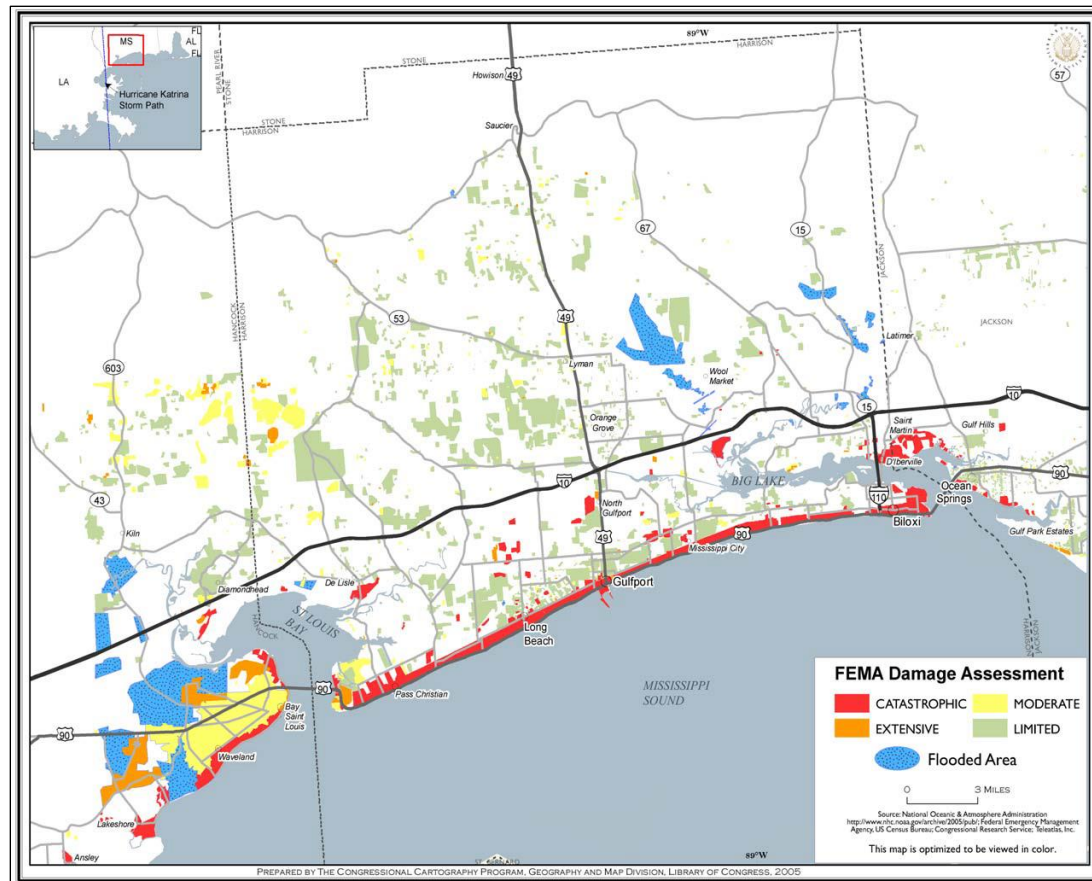
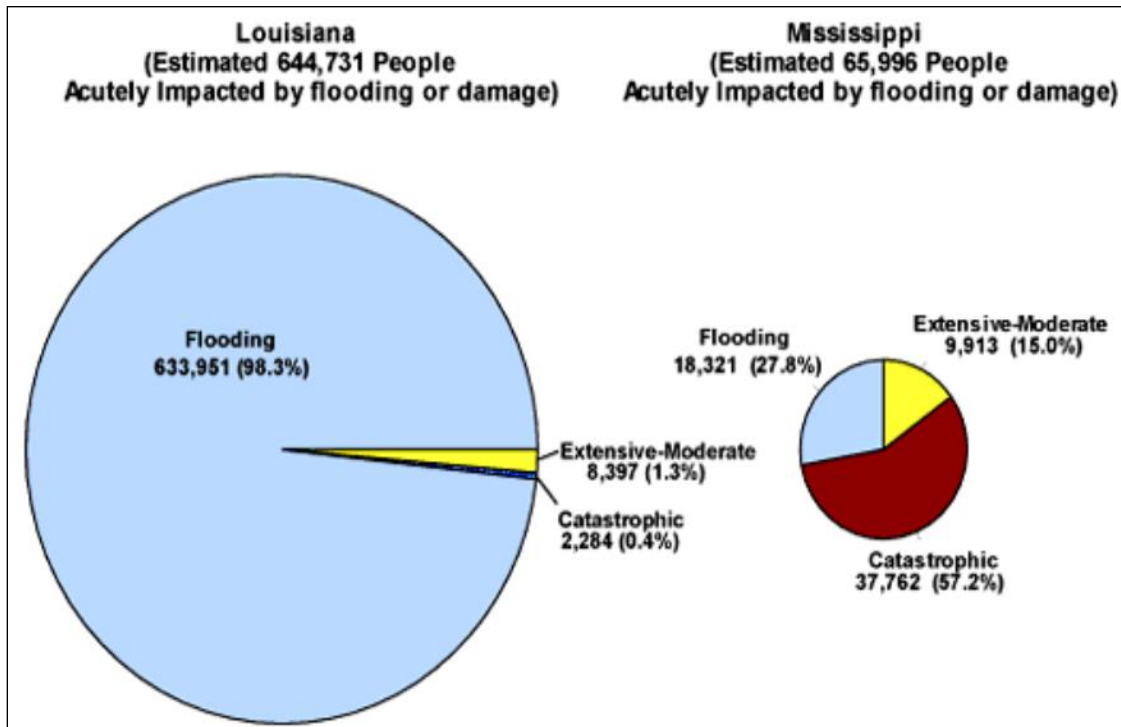


Figure 5 depicts the relative impact of flood and storm damage from Hurricane Katrina in Louisiana and Mississippi in terms of the estimated number of people affected.

Figure 5. Hurricane Katrina: Comparative Impact of Flooding and Storm Damage in Louisiana and Mississippi

(Estimated Number of People Impacted based on 2000 Census Data)



Source: Estimates prepared by the Congressional Research Service (CRS) with assistance from the Library of Congress Congressional Cartography Program, based on analysis of FEMA flood and damage assessments and U.S. Census 2000 Summary File 4 (SF4) data files.

Hurricane Katrina—Social Impacts

Hurricane Katrina likely made one of the poorest areas of the country even poorer. Among those displaced by the storm, many lost their homes, material possessions, and jobs. Some had insurance to replace their material property losses, received help from FEMA or Small Business loans to get by on an emergency basis or replace property, or received unemployment insurance or disaster unemployment insurance to replace lost wages. However, some who lived in the areas most impacted by the storm may now be destitute; while having financially gotten by before the storm, in the storm's aftermath they may have joined the ranks of the poor. Further, the socio-economic profile of the areas hardest hit by Katrina indicates that these newly poor would join a population that was already disproportionately poor and disadvantaged. Before the storm, the 700,000 people acutely affected by Katrina were more likely than Americans overall to be poor; minority (most often African-American); less likely to be connected to the workforce; and more likely to be educationally disadvantaged (i.e., not having completed a high school education). Both those who were poor before the storm, and those who have become poor following the storm, are likely to face a particularly difficult time in reestablishing their lives, having few if any financial resources upon which to draw.

Mass Displacement

The economic and social impact of Hurricane Katrina will be felt for years to come. The hurricane resulted in mass displacement of people and fractured communities. Estimates of the number of people displaced range widely; the analysis in this report assumes 700,000 were acutely impacted, Secretary Chertoff has stated that FEMA has sheltered over 600,000,⁹ and media reports have cited figures as high as 1.2 million in describing the displaced.¹⁰ At their peak, shelters were housing over 270,000 evacuees,¹¹ but, as of October 19, fewer than 8,000 were still in shelters. While some families have already returned home, many are living in interim housing, including FEMA-provided trailers, and apartments, paid for in part with grants from FEMA. FEMA reports, as of September 26, that it has approved over 265,000 applications for temporary housing payments¹² and, as of October 19, has provided just under 12,000 trailers.¹³

Whether these families will eventually return home or resettle in new communities is unclear and will not be fully known until the reconstruction of the Gulf Coast is complete. Regardless, individuals, families, and communities have been, and will be, dramatically transformed by the storm.

Disproportionate Effects on Minorities and the Poor

Hurricane Katrina disproportionately impacted communities where the poor and minorities, mostly African-Americans, resided. The three states where communities were damaged or flooded by the hurricane rank among the poorest in the nation. According to the 2000 Census, Mississippi ranked second only to the District of Columbia in its poverty rate; Louisiana was right behind it ranking third, and Alabama ranked sixth. CRS estimates that about one-fifth of the population most directly impacted by the storm was poor. That poverty rate (21%) was well above the national poverty rate of 12.4% recorded in the 2000 Census.¹⁴

Figure 6 shows the national poverty rate alongside the rates for Alabama, Louisiana, and Mississippi. Moreover, the figure shows how the national and statewide rates compare to rates in the storm-damaged or flooded areas in the three affected states combined, and individually. The poverty rates in the storm-damaged or flooded areas generally reflect the high poverty rates for the region as a whole, and are higher than the national average (12.4%) in each of the three states, although the poverty rate for the damaged areas of Mississippi was considerably below the state's overall poverty rate. The poverty rate for storm-damaged areas in all three states combined

⁹ Prepared testimony of Department of Homeland Security Secretary Chertoff before the House Select Committee on Hurricane Katrina, October 19, 2005.

¹⁰ Katrina Exodus Reaches All States, Haya El Nasser and Paul Overberg, USA TODAY, September 28, 2005.

¹¹ Governmental Gulf Coast Response to Hurricanes Katrina and Rita, FEMA press release, October 25, 2005, Release Number: 1603-116.

¹² FEMA Distributes Almost \$625 Million In Expedited Housing Assistance In First Two Days, FEMA press release, September 26, 2005, Release Number: HQ-05-306.

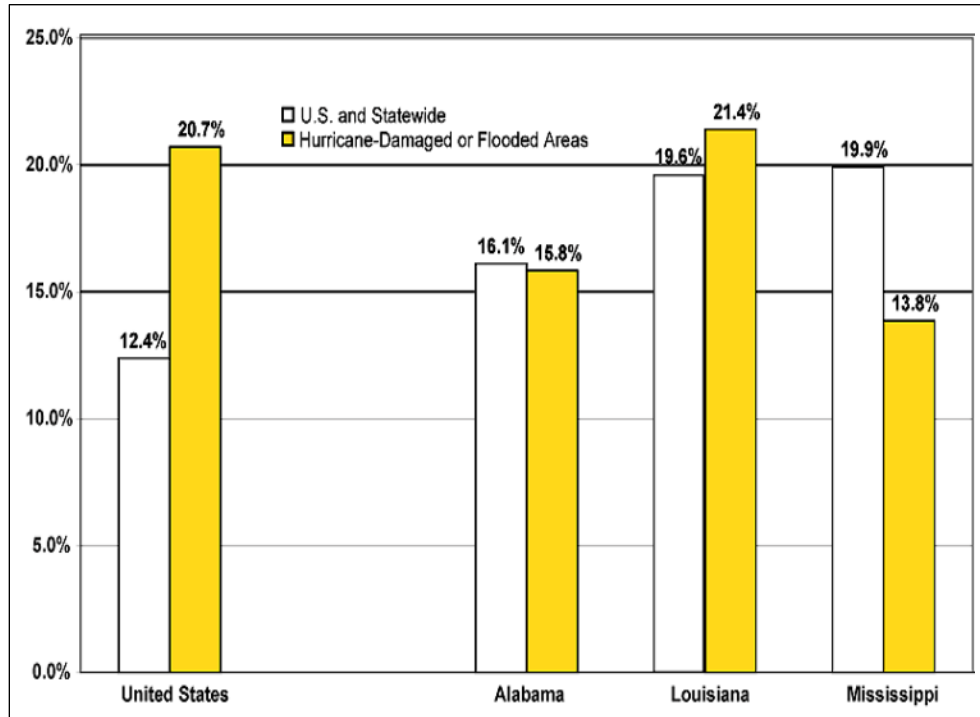
¹³ Department of Homeland Security Report to Congress, October 20, 2005, available at http://appropriations.house.gov/_files/HurricaneKatrinaLink.htm.

¹⁴ The poverty rate is the percent of the population considered poor, by the official Census Bureau definition of poverty. Census Bureau poverty income thresholds demarcate income levels to which families' incomes are compared for determining poverty status. Poverty income thresholds vary by family size, and composition (e.g., number of related children, or for individuals and couples, by whether the householder is age 65 or older, or younger). In 2004, for example, the weighted average poverty threshold for a 4-person family was \$19,307, for a 2-person family, \$12,334, and for one person, living alone (unrelated individual), \$9,645. Poverty thresholds are adjusted each year for changes in prices (CPI-U).

(20.7%) is determined mostly by the high poverty rates in the flooded and damaged areas of Louisiana, which has most of the population of the storm-damaged and flooded areas.

Figure 6. Poverty Rates for the United States, Alabama, Louisiana, and Mississippi, and Hurricane Katrina Flood or Storm-Damaged Areas

(Based on 2000 Census Data)



Source: Estimates prepared by the Congressional Research Service (CRS) with assistance from the Library of Congress Congressional Cartography Program, based on analysis of FEMA flood and damage assessments and U.S. Census 2000 Summary File 4 (SF4) data files.

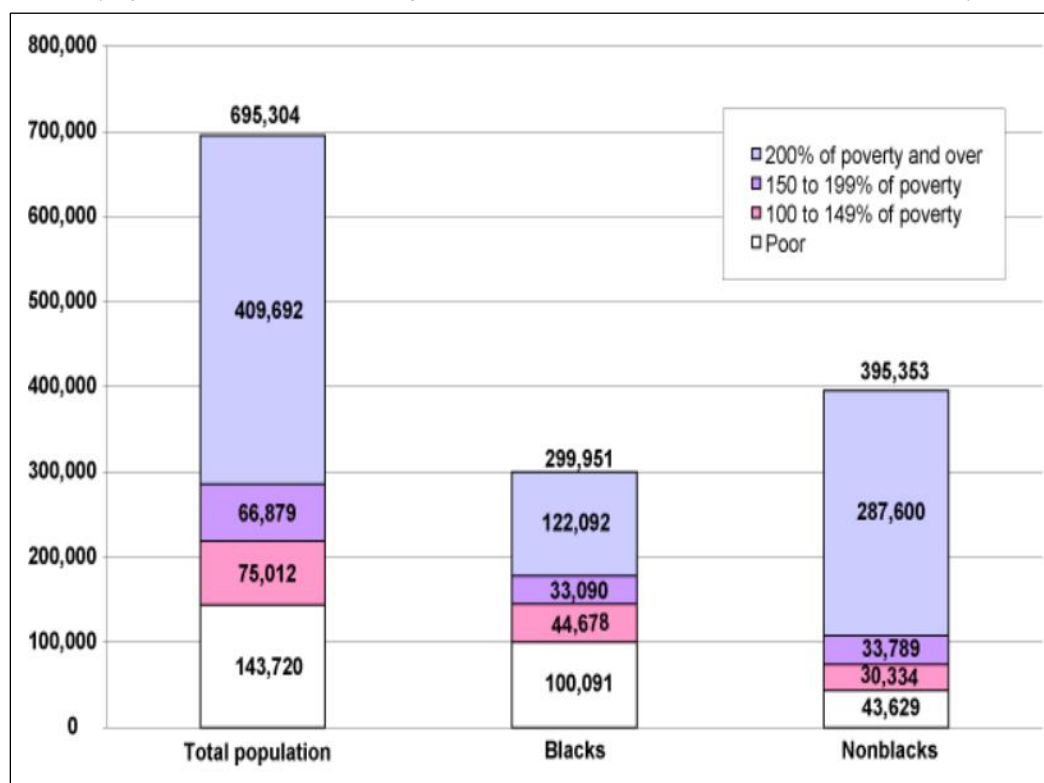
Note: Population for who poverty status is determined. Excludes persons living in institutions and unrelated individuals under age 15.

As noted above, CRS estimates that about one-fifth of the population most directly impacted by the storm was poor (144,000 people). In addition, over 30% of the most impacted population had incomes below one-and-one-half times the poverty line and over 40% had income below twice the poverty line (see **Figure 7**).¹⁵

¹⁵ Note, the estimates shown in **Figures 6** and **7** are for persons for whom poverty status was determined in the 2000 Census. Persons living in institutions and unrelated individuals (e.g., foster children) under the age of 15 are excluded from these estimates.)

Figure 7. Estimated Number of Persons in Hurricane Katrina Flood or Storm-Damaged Areas, by Race and Poverty Status in 1999

(Population for whom Poverty Status is Determined based on 2000 Census Data)



Source: Estimates prepared by the Congressional Research Service (CRS) with assistance from the Library of Congress Congressional Cartography Program, based on analysis of FEMA flood and damage assessments and U.S. Census 2000 Summary File 4 (SF4) data files.

Note: Population for who poverty status is determined. Excludes persons living in institutions and unrelated individuals under age 15.

The hurricane's impact on New Orleans also took a disproportionate toll on African Americans. An estimated 310,000 black people were directly impacted by the storm, largely due to flooding in Orleans Parish. Blacks are estimated to have accounted for 44% of storm victims. In Orleans Parish, an estimated 272,000 black people were displaced by flooding or damage, accounting for 73% of the population affected by the storm in the parish. In contrast, an estimated 101,000 non-black people in Orleans Parish were displaced by flooding or damage, accounting for about 63% of the non-black population living in the parish; still a high proportion affected, but somewhat less than that experienced by blacks.

Among blacks living in Orleans Parish who were most likely displaced by the storm, over one-third (89,000 people, or 34.0% of displaced blacks) were estimated to have been poor, based on 2000 Census data. Among non-black (predominantly white) persons living in the parish who were likely displaced by the storm, an estimated 14.6% (14,000) were poor.

The Aged

The aged may have been especially affected by Katrina. Many had close ties to their communities, having resided there for years, and for some, their entire lifetimes. Some may have found it more difficult than others to evacuate. The elderly are more likely to live alone, and less

likely to own a car, or be able to drive. Some may have been more isolated, living alone, or homebound due to frailty or disability.

Home Ownership Status and Community Ties

Among households headed by persons age 65 or older who were likely displaced by the storm, 70% are estimated to have owned their own home—an ownership rate higher than any other age group. Among aged homeowners likely displaced by the storm, over 70% had lived in their homes for over 20 years, and 47% over 30 years, in the year 2000. Among likely displaced aged renters, an estimated 55% had lived in their rental units for over 20 years, and 36% over 30 years, based on 2000 Census data.

Living Arrangements

An estimated 88,000 persons age 65 and older were likely displaced by Hurricane Katrina, or 12.4% of the population affected by flooding and/or storm damage. Among the aged population affected, an estimated 27,000 lived alone, in one-person households, which accounted for 41% of households with an aged member.

The hurricane likely displaced an estimated 45,000 persons age 75 and older, a population prone to frailty. Among this group, nearly 15,000 are estimated to have lived alone, in one-person households, which accounted for 45% of the households with a member age 75 or older.

Disability Status

Nearly half (48%) of all persons age 65 or older living in flooded or damage-affected areas reported having a disability, and over one-quarter (26%) reported two or more types of disability.¹⁶ Reported disabilities included sensory disabilities (blindness, deafness, or severe hearing impairment), and other disabilities reflecting conditions lasting more than six months that limit various activities. These activity-limiting disabilities include mental disabilities (difficulty learning, remembering, or concentrating); self-care disabilities (difficulty dressing, bathing, or getting around inside the home); and, going outside disabilities (difficulty going outside the home alone to shop or visit a doctor's office). An estimated 13% of persons age 65 and older in the flood or damage affected areas reported a self-care disability, and 19% of those age 75 and older; one-quarter of those age 65 and older reported a disability that made it difficult to go outside, unassisted, and of those age 75 and older, one-third reported such a disability.

Poverty Status

Among aged persons likely displaced by the storm, an estimated 12,600, based on 2000 Census data, were poor, or about 14.7% of the aged displaced population, and nearly 23,600 (27.6%) had incomes below 150% of the poverty line.

Vehicle Availability

Among all households living in the flood or damage-affected areas, an estimated 19% had no vehicle available to the household. Among households with heads age 65 or older, over one-quarter (26%) were without a vehicle, and among those age 75 or older, one-third (33%). In order to evacuate from the storm, these households would have been dependent on other nonresident family members, friends, neighbors, or public or specially arranged transportation.

¹⁶ Civilians living in noninstitutionalized settings.

Children

About one-fourth of the people who lived in areas damaged or flooded by Hurricane Katrina were children (under age 18). Hurricane Katrina struck at the beginning of the school year, potentially displacing an estimated 183,000 children, based on CRS analysis of 2000 Census data, including an estimated 136,000 children who were of school age. An estimated 47,000 children under the age of 5 lived in neighborhoods that experienced flooding or damage from the hurricane.

Child Poverty Rates in Areas Acutely Affected by Hurricane Katrina

The characteristics of the children in the damaged and flooded areas reflect greater disadvantage compared with the characteristics of children in the nation as a whole. Many of the children in affected areas were poor. **Table 2** shows the number of poor children and the child poverty rate in the affected areas. Note that the number of children for whom the Census Bureau determines poverty status (180,000) is slightly less than the total for all children in these areas (183,000), because poverty is not determined for children under the age of 15 who live in group quarters (e.g., foster children). The poverty rate of 30% for children in hurricane-flooded or damaged areas is almost twice the 2000 Census child poverty rate for the nation as a whole of 16.6%.

Table 2. Number and Poverty Rate for Children in Hurricane Katrina Flooded or Damaged Areas

	Total	Poor	Percent Poor
Age 0-4	46,025	15,079	32.8%
Age 5-17	134,077	39,567	29.5
Total Under 18	180,102	54,646	30.3

Source: Estimates prepared by the Congressional Research Service (CRS) with assistance from the Library of Congress Congressional Cartography Program, based on analysis of FEMA flood and damage assessments and U.S. Census 2000 Summary File 4 (SF4) data files

The table shows that about 15,000 children of preschool age (age 0-4), or about one-third of all children in that age group, were poor. Another 40,000 school age children who lived in flooded or hurricane-damaged areas were poor.

Over half (55%) of the children most likely to have been displaced by the hurricane were African-American based on 2000 Census data. Approximately 45% of the displaced black children were estimated to have been poor (about 45,000 children), accounting for 25% of all children displaced by the storm, and 82% of all *poor* displaced children.

Living Arrangements of Children in Hurricane-Affected Areas

Children in the areas damaged and flooded by Hurricane Katrina were more likely than children nationwide to live in female-headed families. **Table 3** shows the percent of children¹⁷ in the hurricane-damaged or flooded areas by their family type—whether they lived in a family headed by a married couple or single female or male head. Overall, 38% of children under the age of 18 in the hurricane-affected areas lived with a female head; nationally, this percentage is 20%. Children in female-headed families are more likely to be poor than children living in married couple or other families. (According to the 2000 Census, nationwide, 41% of children in female-headed families were in poverty versus an overall poverty rate of 16%.) Further, a single mother often needs child care to enter the workforce or remain working. In the Hurricane Katrina-

¹⁷ Own children, related by birth or adoption to the family head.

damaged and flooded areas, there were 12,000 preschool children living in families headed by a single mother. The high rate of children living with single mothers also is consistent with the hurricane having disproportionately affected African-Americans, as African-American children are more likely than children of other racial and ethnic groups to be raised by a single mother.

Table 3. Own Children in Hurricane Katrina Flood and Storm-Damaged Areas, by Age and Family Type

	U.S. Average	Hurricane Katrina-Damaged or Flooded Areas
Under Age 5		
In married couple families	77.3%	59.5%
In female-headed families (no husband present)	17.1	34.2
In male-headed families (no wife present)	5.6	6.3
Age 5-17		
In married couple families	73.8	56.0
In female-headed families (no husband present)	21.0	38.8
In male-headed families (no wife present)	5.2	5.2
Total Under Age 18		
In married couple families	74.7	56.8
In female-headed families (no husband present)	20.0	37.7
In male-headed families (no wife present)	5.3	5.5

Source: Estimates prepared by the Congressional Research Service (CRS) with assistance from the Library of Congress Congressional Cartography Program, based on analysis of FEMA flood and damage assessments and U.S. Census 2000 Summary File 4 (SF4) data files.

Working-Age Adults

The disproportionate impact of Hurricane Katrina on the poor is also shown through other indicators of disadvantage. Hurricane-damaged areas tended to have lower labor force participation rates and higher unemployment rates than the nation as a whole.

Labor Force Participation

Persons who are either with a job (employed), or actively searching for work (unemployed) are considered as participating in the labor force. Labor force participation among men—both youth (aged 16-24) and adults (aged 25-64)—in the hurricane-damaged areas was considerably below that in the nation as a whole. The labor force participation rate for male youths in hurricane-damaged areas was 55%, compared with a nationwide average rate of 65%. For adult men, the labor force participation rate was 77% in hurricane-damaged areas, compared with an 82% rate on average nationwide. Additionally, unemployment rates for both youth and adult men were higher in hurricane-damaged areas than nationally.¹⁸ The combined lower levels of labor force participation and higher unemployment meant that a larger share of men in hurricane-damaged

¹⁸ Unemployment rates for male youth (16-25) were 16.9% in the areas acutely affected by the hurricane, and 13.9% nationwide. For prime working-aged men (25-64), the unemployment rate in hurricane damaged or flooded areas was 5.8%, compared with 4.2% nationwide.

areas were not working than is true nationally. Overall, an estimated 72,000 men over the age of 16 were not working. Of this number, 47,000 were age 25-64.

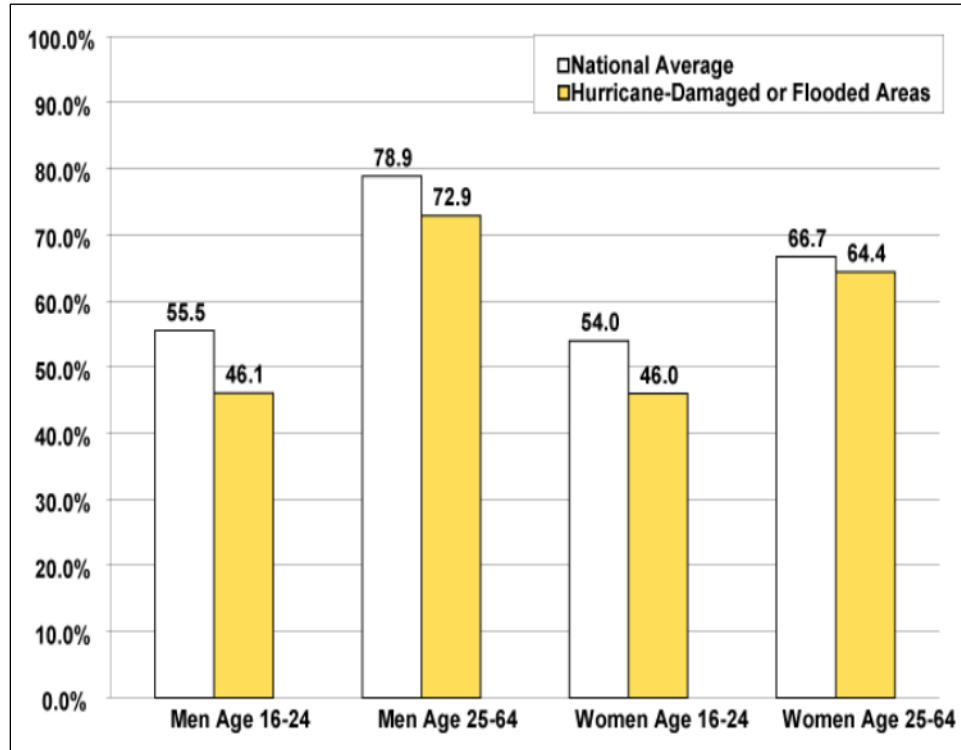
The labor force participation and work status of young women (aged 16-24) is similar to that for young men: lower labor force participation rates than the national average (57% versus 62% nationally) and higher rates of unemployment. Almost 19% of young women aged 16-24 in hurricane-damaged or flooded areas were unemployed, an even higher unemployment rate than observed for young men. However, women aged 25-64 in hurricane-damaged areas had very similar labor force participation rates to the national average, though their unemployment rates were above the national average.

Employment Population Ratio

Figure 8 shows the employment-population ratio for youths (age 16-24) and prime working age adults (age 25-64) for the nation as a whole and for the areas damaged or flooded by Hurricane Katrina for men and women. The employment-population ratio is the percentage of the population actually employed. For all groups, those in the areas acutely affected by the hurricane had lower employment rates than for the nation as a whole. However, for men, both youths and prime working-aged men, the employment-population ratio in hurricane-affected areas was substantially lower than the national average, reflecting both lower labor force participation and higher unemployment rates for men. Employment-population ratios for young women in hurricane-affected areas were also substantially below national averages. However, the employment-population ratio for prime working-aged women in hurricane-affected areas was only slightly below average.

Figure 8. Employment-Population Ratios for Youth and Prime Working-Age Men and Women in Hurricane Katrina Flood or Storm-Damaged Areas Compared with National Averages

(Based on 2000 Census Data)



Source: Estimates prepared by the Congressional Research Service (CRS) with assistance from the Library of Congress Congressional Cartography Program, based on analysis of FEMA flood and damage assessments and U.S. Census 2000 Summary File 4 (SF4) data files.

Education

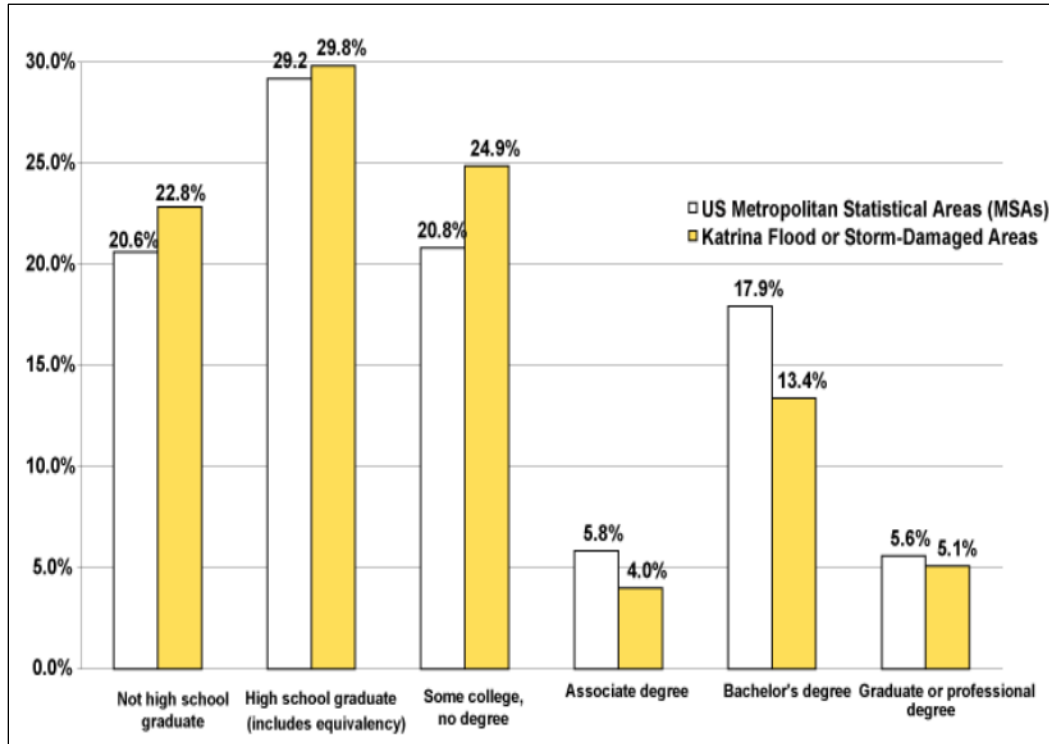
The adult population living in hurricane-damaged or flooded areas was also educationally disadvantaged relative to the averages for the nation as a whole. Overall, 23% of adults (aged 25 and over) in storm-damaged or flooded areas lacked a high school diploma, representing 106,000 people.

Younger adults living in hurricane-damaged or flooded areas had lower levels of educational attainment compared to their counterparts living in U.S. metropolitan areas overall.¹⁹ Among younger adults, age 18 to 34, who were not enrolled in school, 22.8% had not attained a high school diploma, or its equivalent, compared to 20.6% in U.S. metropolitan areas overall. (See **Figure 9**.) In U.S. metropolitan areas overall, 29.3% of younger adults who were no longer in school had attained a post-secondary school degree (associates, bachelors, graduate or professional degree), compared to 22.5% of those living in Katrina storm or flood-damaged areas.

¹⁹ Here, the comparison is made to metropolitan statistical areas (MSAs), nationwide, as the population in metropolitan areas is generally more highly educated than in non-metropolitan areas. The population in the 14 counties included in this analysis all live within a metropolitan area (either the New Orleans, Louisiana, Biloxi-Gulfport-Pascagoula, Mississippi, or Mobile, Alabama MSAs).

Figure 9. Educational Attainment of Younger Adults (Age 18 to 34) in Hurricane Katrina Flood or Storm-Damaged Areas Compared to U.S. Metropolitan Areas Overall

(Based on 2000 Census Data)



Source: Estimates prepared by the Congressional Research Service (CRS) with assistance from the Library of Congress Congressional Cartography Program, based on analysis of FEMA flood and damage assessments and U.S. Census 2000 Summary File 4 (SF4) data files.

Note: Estimates are for younger adults not enrolled in school.

Aggregate Earnings Losses

At the time of the 2000 Census, households living in the hurricane-damaged or flooded areas had estimated aggregate annual earnings in 1999 of \$10 billion. This figure includes wages and salaries, and net self-employment income. Additionally, employers in the affected areas may have depended on workers who lived in areas that were less severely impacted by the storm, and their earnings are not included in this estimate. Some of the workers in the most affected areas may have had jobs elsewhere, in less affected areas, and could conceivably retain their jobs and earnings. The estimated \$10 billion in earnings of households that lived in hurricane-damaged or flooded areas amounts to nearly 29% of the total earnings of all households living in the 14 county area. The \$10 billion aggregate earnings figure, cited above, is only a crude approximation of potential lost earnings in the affected areas, reflecting economic circumstances of households in 1999, not 2005, but even by this crude measure, the impact is substantial.

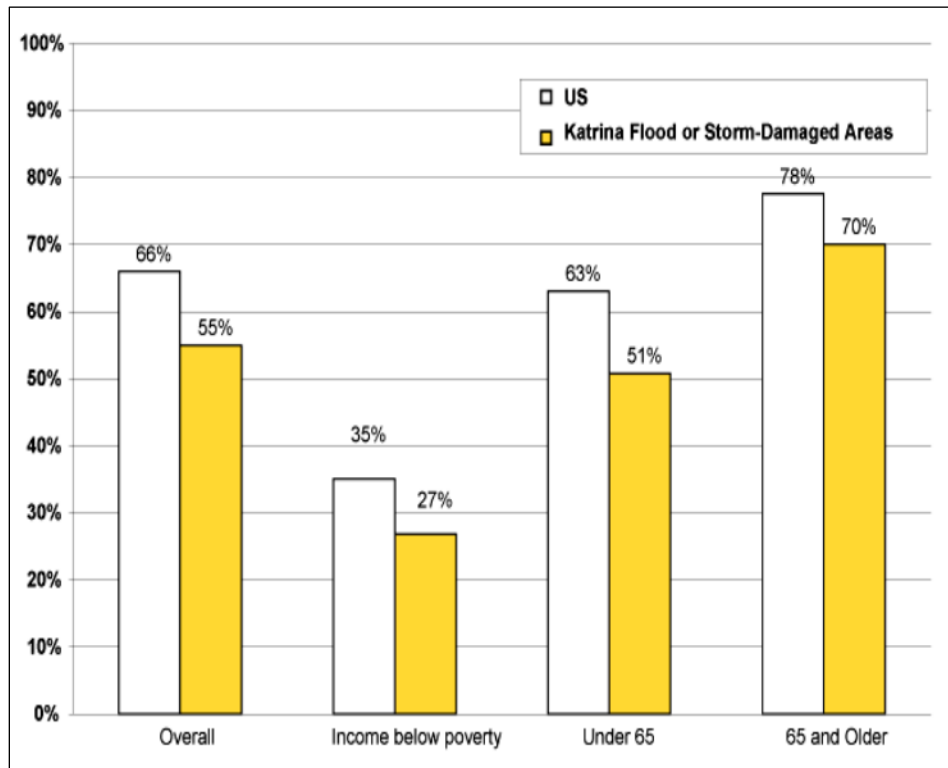
Homeownership and Housing Characteristics

For most American families, a home is or will be their largest investment and asset. It can be a source of equity and financial stability, as well as a tie to the community. Another indicator of the pre-hurricane financial disadvantage in the areas impacted by Hurricane Katrina is the low rate of homeownership. According to CRS analyses, the area most heavily impacted by Hurricane

Katrina had a lower than average proportion of homeowners. The rate of homeownership among all households in occupied housing units was 66% nationally in 2000, according to Census figures, but was only 55% in the Katrina-impacted areas. As shown in **Figure 10**, this lag existed for the elderly, the non-elderly as well as the poor.

Figure 10. Percent of People Living in Owner-Occupied Housing in Hurricane Katrina Flood or Storm-Damaged Areas Compared to the Nation

(Based on 2000 Census Data)



Source: Estimates prepared by the Congressional Research Service (CRS) with assistance from the Library of Congress Congressional Cartography Program, based on analysis of FEMA flood and damage assessments and U.S. Census 2000 Summary File 4 (SF4) data files.

It is unclear whether this lower rate of homeownership will impact the return of residents displaced by Hurricane Katrina. Renters are more mobile and may have an easier time resettling in new communities than homeowners, who will need to either repair and return to damaged homes or sell them, assuming that they are worth more than the amount of debt still owed on them. Note that 65% of owner-occupied homes in the impacted region had some form of mortgage at the time of the 2000 Census. While Census data cannot answer the question of who will return, the data do indicate that homeowners in the impacted areas had lived in their homes for many years, possibly indicating strong community ties. More than half of all homeowners had lived in their homes for 20 or more years (compared to 42% nationally), and just under a third had lived in their homes for 30 or more years (compared to 22% nationally). The data also indicate that, despite their general mobility, renters may also have had strong ties, with 29% having lived in their homes for 10 years or more (compared to 23% nationally).

Most homeowners in impacted areas lived in single-family homes (69%), although a larger share than the national average lived in mobile homes (25%, compared to 8% nationally). The finding

that a high percentage of homes in the damaged areas are mobile homes is not surprising, given the lower incomes in the impacted areas as well as mobile homes' susceptibility to damage.

Overall, an estimated 55% of 278,000 households impacted by the storm owned their own home. Among poor households, over one-quarter owned their home (27%); among non-poor households, over three-fifths (62%).²⁰

About a quarter of all owners and 46% of all renters in the impacted areas had at least one housing condition as of the 2000 Census. Housing conditions are defined as paying more than 30% of income toward housing costs (the standard considered affordable), living with more than 1.01 person per room (the standard for overcrowding), and lacking complete plumbing and/or kitchen facilities (the standard for housing inadequacy). These rates are consistent with the national averages (of 24% of owners and 43% of renters). It is likely that these measures of inadequacy and/or affordability will change as housing is rebuilt and new stock is added after the hurricane.

Status of Other Assessments

This report's analysis is based on the merger of FEMA flood and damage assessments (data of September 21, 2005) with Census 2000 data. The FEMA flood and damage assessments are derived from interpretations of satellite and aircraft overflight imagery of the impacted area, combined with analysts' assessments on the scene. The FEMA flood and damage assessments were primarily derived from interpretations of aerial imagery, which may be limited by the range of the flights as well as subject to errors in categorizing areas. (The FEMA flood assessment represents the high-water mark of hurricane-related flooding, not the level of flooding on September 21.) Although the data from Census 2000 are now more than five years old, they are the only currently available data at the geographic scale required (Census Blocks and Tracts) to infer the social and demographic characteristics of populations who were likely directly impacted by hurricane damage and/or flooding. The estimates presented in this report rely heavily on the completeness and accuracy of the FEMA flood and damage assessment data. The FEMA data are likely to have captured most, but not all hurricane-related damage, and miss inland damage along the hurricane's storm track through Mississippi (mostly less than catastrophic damage).

The data that were used in this report are not the only data being developed to assess Hurricane Katrina's impact. More will become available as time goes on. In terms of categorizing the damage, the NOAA (National Oceanic and Atmospheric Administration) has continued to conduct flyovers of the impacted area and update its data, especially as flood waters have receded. Further, local officials and insurance adjusters have now gone into many of the impacted areas to conduct thorough assessments of structural damage. The American Red Cross has also conducted a structure-by-structure damage assessment. Using trained volunteers and damage categories aligned with FEMA, the American Red Cross has estimated that 885,791 structures were impacted by Hurricane Katrina, of which 492,576 were either destroyed (352,930) or sustained major damage (139,646). The breakdown, as of October 3, 2005, is as follows:

²⁰ Here, poverty status is determined by the poverty status of the householder.

Dwelling Type	Destroyed	Major Damage	Minor Damage	Affected	Inaccessible	Total
Single Family	310,353	102,297	135,879	127,290	1,769	667,588
Manufactured	1,815	3,388	6,692	5,834	248	17,977
Apartment	40,762	33,961	27,881	52,551	341	155,226
Total	352,930	139,646	170,452	185,675	2,358	840,791

Source: Greg Tune, American Red Cross. Numbers verbally presented at Housing Statistics Users Group meeting on Tuesday, October 25, 2005 at the National Association of Home Builders Headquarters, Washington, DC.

Note: More recent Red Cross data discussed below are not included in this table because they include Hurricane Rita.

Further assessments conducted by the American Red Cross suggest that the FEMA damage assessment does not capture the full extent of inland damage, concentrated largely along Hurricane Katrina's storm track in Mississippi. The FEMA damage assessment accounts for damage in just three Mississippi Counties—Hancock, Harrison, and Jackson—that are situated directly on the Gulf Coast. Information obtained from the American Red Cross indicate 4,609 destroyed dwellings in areas that are outside of these three counties, accounting for 6.7% of all destroyed dwellings (68,729) in Mississippi.²¹ The Red Cross's assessment identifies a total of 65,237 dwellings that suffered major damage (e.g., large portions of roofs missing, extensive wall damage) in Mississippi, of which 45.9% (29,917) were located in inland counties, not included in the FEMA assessment and therefore not included in this CRS analysis.

The best source of data about the families who were displaced as a result of Hurricane Katrina is the FEMA database of registrants. By early October, over 2 million individuals and households (not all necessarily displaced) had registered with FEMA for disaster assistance as a result of hurricanes Katrina and Rita.²² That database includes information about each person who has registered for assistance after the disaster, including information about where they lived prior to evacuation and where they are living after the disaster, based on postal zip codes. While not publicly available, at least one newspaper has had access to the zip code information and has published a map showing where families were from and where they have gone.²³ While FEMA has stated it is concerned about the privacy rights of registrants,²⁴ it can be expected that more information about displaced families will become available in the future from this database.

²¹ Red Cross damage assessment data, dated October 13, 2005. Provided to the Housing Statistics Users Group (HSUG) via the National Association of Home Builders on November 4, 2005.

²² Requests For Disaster Assistance Exceeds Two Million For 2005, More Than 1.9 Million Registrations for Katrina and Rita Received in One Month, FEMA press release, October 4, 2005, Release Number: HQ-05-321

²³ Katrina Exodus Reaches All States, Haya El Nasser and Paul Overberg, USA TODAY, September 28, 2005.

²⁴ FEMA Restricts Evacuee Data, Citing Privacy: Families and Police Protest, By John Pomfret, Washington Post, October 12, 2005.

Appendix. Methodology

The estimates presented in this report are based on FEMA flood and damage assessment data, combined with Census 2000 demographic and geographic boundary data. The FEMA flood and damage assessments are as of September 21, 2005.²⁵ They reflect FEMA's assessment of areas affected by structural damage and/or flooding, based on remote sensing imagery (satellite and aircraft) interpretation, combined with analysts' assessments on the scene. (The FEMA flood assessment represents the high-water mark of hurricane-related flooding, not the level of flooding on September 21.) FEMA data files showing the areas affected by flooding and/or structural damage were obtained and mapped into a Geographic Information System (GIS) by a Library of Congress cartographer. Among its other features, the GIS contains U.S. Census population and geographic boundary data, and provides the facility for geo-spatial analysis and mapping. The GIS was used to apportion areas of assessed damage and/or flooding to Census Blocks, and then to aggregate Census Blocks up to Census Tracts. Flood and damage apportionment factors were then applied to Census 2000 Tract-level data in order to assess impacted areas in terms of the social-demographic characteristics of the population most likely to have been directly affected by the hurricane.

As noted in the body of the report, the estimates are based on 2000 data, reflecting the number and characteristics of the population at that time—as if the hurricane struck in April 2000, as opposed to August 2005. Numbers presented in this report are estimates, providing a rough approximation of the numbers and characteristics of persons, families, and households that are most likely to have been impacted by the hurricane. The estimates are based on the methodology described above, and rely heavily on the completeness and accuracy of the FEMA flood and damage assessment data.

Subsequent and ongoing assessments conducted by the American Red Cross suggest that the FEMA damage assessment does not capture the extent of inland damage, concentrated largely along Hurricane Katrina's storm track through Mississippi. The FEMA damage assessment accounts for damage in just three Mississippi Counties—Hancock, Harrison, and Jackson—that are situated directly on the Gulf Coast. Information obtained from the American Red Cross indicate 4,609 destroyed dwellings in areas outside of these three counties, accounting for 6.7% of all destroyed dwellings (68,729) in Mississippi.²⁶ The Red Cross's assessment identifies a total of 65,237 dwellings that suffered major damage (e.g., large portions of roofs missing, extensive wall damage) in Mississippi, of which 45.9% (29,917) were located in inland counties, not included in the FEMA assessment and therefore not included in this CRS analysis.

FEMA Flooding and Damage Assessments

The FEMA flooding and structural damage data are based on separate assessments. Consequently, areas with flooding and structural damage may overlap. Structural damage is characterized at four different levels:

- *Catastrophic Damage:* Most solid and all light or mobile structures are destroyed;

²⁵ FEMA, ITS Mapping and Analysis Center, flood and damage assessment as of September 21, 2005. <http://www.gismaps.fema.gov/2005pages/rsdrkatrina.shtm>.

²⁶ Red Cross damage assessment data, dated October 13, 2005. Provided to the Housing Statistics Users Group (HSUG) via the National Association of Home Builders on November 4, 2005.

- *Extensive Damage*: Some solid structures are destroyed; most sustain exterior and interior damage (e.g., roofs are missing, interior walls exposed), most mobile homes and light structures are destroyed;
- *Moderate Damage*: Solid structures sustain exterior damage (e.g., missing roofs or roof segments); some mobile homes and light structures are destroyed, many are damaged or displaced;
- *Limited Damage*: Generally superficial damage to solid structures (e.g., loss of tiles or roof shingles); some mobile homes and light structures are damaged or displaced.

Recategorization into Non-Overlapping Areas

GIS methods were applied to separate areas with flooding or structural damage only, from those areas where flooding and structural damage overlapped, in order to avoid double counting. Ten mutually exclusive areas were initially derived: 1) Flooding Only, 2) Catastrophic Damage Only, 3) Extensive Damage Only, 4) Moderate Damage Only, 5) Limited Damage Only, 6) Flooding and Catastrophic Damage, 7) Flooding and Extensive Damage, 8) Flooding and Moderate Damage, 9) Flooding and Limited Damage, 10) No Flooding or Damage.

Apportion Census Block Populations by Flood/Damaged Areas

The areas of assessed damage and/or flooding, defined above, were apportioned by Census Block (the smallest unit of Census geography), based on the population in the Block, and the Block's overlapping and non-overlapping habitable area (i.e., land, as opposed to water) with the assessed damage areas. Census Block boundaries are not coincident with the geographic boundaries of the assessed damaged and/or flooded areas. In order to apportion the 10 mutually exclusive categories (mentioned above), an areal percentage of the overlapping damaged and/or flooded area was applied to the Census 2000 Block population. To do this, we had to make the assumption that population is evenly distributed within the Census Block. Because of the small area geography of the Census Block, error introduced at the Block level is less than it would be if the apportionment methodology had been implemented directly at the Tract level. Apportioned Census Block populations, by percent in flood areas, and/or areas with assessed structural damage, were then aggregated by Census Tract, to arrive at apportionment rates for the Tract, for flooding and/or level of structural damage, based on the 10 non-overlapping areas, defined above.

Apportionment Rates Applied to Census 2000 Tract-Level Data

The apportionment rates, derived above, were then applied to Census 2000 data, summarized at the Census Tract level.²⁷ The Census 2000 summary Tract level data provide the lowest level of geographical detail that is publicly available on a broad range of social, demographic, income, and housing characteristics of the population.

As an example, if a Census Tract had a population in 2000 of 3,200 people²⁸ and 20% of its population was estimated to have lived in a flooded area based on the Census Block population apportionment rate procedure described above, then 640 people would be estimated to have lived in flooded areas, and 2,560 in non-flooded areas. If 40% of that Census Tract's population was

²⁷ U.S. Census 2000 Summary File 4 (SF4) data files. Documentation for these files may be found at <http://www.census.gov/prod/cen2000/doc/sf4.pdf>.

²⁸ Of the 510 Census Tracts identified as having any damage or flooding based on the analysis of the FEMA damage flood assessment data, the median population in 2000 numbered 3,213. Half of the 510 Census Tracts covered less than a square mile. One-quarter of the Tracts covered less than 0.38 square miles, and one-quarter over 5.8 square miles.

African American (1,280 people), then, under the methodology employed, the same share for the Tract's overall population estimated to live in its flooded area (i.e., 20%), would be applied to the black population in the Tract (1,280), to arrive at an estimate of 256 black people who lived in the flooded area of the Tract. While the methodology estimates proportionate shares of Census Blocks' populations affected by flooding and/or structural damage at the aggregated Census Tract level, it does not distinguish within a Census Tract where individuals with different characteristics lived. For example, it assumes at the Census Tract level, the entire population was affected proportionately, regardless of their characteristics or where they lived within the Tract.

Regrouping of Areas for Analysis

The ten mutually exclusive areas of flooding and/or damage, described earlier, were regrouped into areas presented in the analysis. Areas with Catastrophic Damage were combined into one grouping, regardless of whether there was also Flooding (i.e., categories 1 and 2, above). All areas with Flooding, other than those that also had Catastrophic Damage (2), were combined into Flooded areas (i.e., 1, 7, 8, and 9, above). Comprehensive data on the depth or duration of flooding by area were not available when we conducted this analysis, so we are unable to distinguish the severity of flooding. Areas without flooding, that had Extensive (3) or Moderate Damage (4) were combined into a single category. Lastly, areas with Limited Damage and no flooding (5) were combined with areas where there was no Flooding or Damage (10).

Among the 14 counties or parishes where any damage or flooding was assessed, the estimated populations in the redefined areas based on their April 2000 Census populations were as follows:

- Catastrophic damage, regardless of flood status (40,000);
- Flooded, excluding areas of catastrophic damage (652,000);
- Non-flooded, extensive damage (5,600);
- Non-flooded, moderate damage (13,700);
- No damage or flooding, or limited damage only (1,747,000).

Author Information

Thomas Gabe
Specialist in Social Policy

Maggie McCarty
Specialist in Housing Policy

Gene Falk
Specialist in Social Policy

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